ORIGINAL ARTICLE

TRENDS in
Sport Sciences
2019; 26(**4**): 171-176
ISSN 2299-9590
DOI: 10.23829/TSS.2019.26.4-5

Kinesio Taping does not alter the blood flow in the area of application – a pilot study

AGATA BRYCHCY, MACIEJ PAWLAK

Introduction. Kinesio Taping is a therapeutic method which was developed in the 1970s by a Japanese chiropractor, Dr. Kenzo Kase. It involves applying tapes to body parts and assumes that the resulting skin folding and lifting causes an increase in the blood flow and lymph flow in this area, speeding up tissue regeneration. The study attempts to verify this thesis by monitoring the blood flow in the area where the tape was applied. Aim of Study. The aim of the pilot study was an attempt to capture the effect of dynamic taping on changes in local blood flow in the upper extremity. Material and Methods. The study included 20 healthy volunteers aged 19-25 years, students of the Poznań University of Physical Education. They were randomly allocated to one of two groups: the control group (n = 5) and the experimental group (n = 15). Both groups were subject to the same measurements (assessing hand grip strength with a dynamometer and blood flow analysis using a PeriFlux System 5000 Perimed, Sweden), however in the control group Kinesio Tape was not applied. Results. The statistical analysis performed in the experimental and control groups showed no statistically significant differences in the blood flow measured in skin blood vessels before tape application, immediately after the application and three hours after the application. In terms of hand grip strength, no statistically significant differences were noted which could indicate the effect of Kinesio Taping increasing the strength of muscle contraction. Conclusions. The pilot study shows that the procedure of applying tape did not result in changes in the hand grip strength in healthy subjects. It was also shown that the method did not cause changes in the blood flow. The results were not statistically significant in both studied groups, control and experimental group, immediately after the application and after 3 hours. It was noted however, that in the experimental group there was a statistically significant relation between hand grip strength and the values of blood flow. Undoubtedly, more studies are necessary on a larger group of subjects in order to confirm the results.

KEYWORDS: Kinesio Tape, blood flow, physiotherapy, Laser Doppler, grip strength.

Received: 12 November 2019
Accepted: 18 December 2019

Corresponding author: aga.ta@o2.pl

University of Physical Education, Chair of Dietetics, Department of Physiology and Biochemistry, Poznań, Poland

Introduction

Kinesio Taping (KT) was developed in the 1970s by a Japanese chiropractor, Dr. Kenzo Kase. He used an elastic, cotton tape to tape up painful body part of athletes [1, 24]. This procedure is supposed to create folds in the skin and increase the space between the skin and the tissues underneath it, leading to normalisation of muscle tone, improved lymph and blood flow, pain relief, speeding up tissue healing processes and improved proprioception [16]. Originally, energy flow pathways, so called meridians, which connect acupuncture points, explained the therapeutic effect of Kinesio Taping and a possible effect on individual organs. It was also assumed that tape application may have a local effect in the place of application and also affect areas beyond the application. Europeans KT instructors, due to the cultural difference of the medicine of the Far East, proposed a more accessible version of the meridian theory, in the form of the myofascial system and the theory of fascial chains [13].

The tape used in KT is covered with hypoallergenic, water resistant glue activated by the heat, which is generated when rubbed [26]. Depending on the illness

and selected method of application tapes of various shapes and degrees of stretch are used [8, 20], six main application techniques can be distinguished [16].
Kinesio Taping is used in orthopaedics, neurology, paediatrics, oncology, gynaecology and obstetrics, among other things. In spite of such a wide area of application of this technique and a few decades of improving KT therapy, there are no study results, which clearly, using objective study methods, indicate the reason behind its effectiveness. Little is explained in this respect by Fukui [7], the creator of the new model explaining the effectiveness of taping based on natural skin properties, in particular its stretchability, determining the return of skin to its original position after stretching and indicating not crossing folds and the median line of the body during movement. The influence of placebo effect on dynamic taping still remains unknown. It should be noted that the number of methodologically correct patient studies is still relatively small. This places Kinesio Taping in the group of methods supporting other therapies [9].
Referring to the therapeutic effect of KT caused by changes in tissue blood flow, attempts were made in recent years to capture these processes, by carrying out studies with a thermal vision camera [27], using brain activity visualisation technique (NIRS, Near Infrared Spectroscopy) [21] or blood flow in skin vessels (LDI, Laser Doppler Imaging) [23], among others.

Aim of Study

The aim of the pilot study was an attempt to capture the effect of dynamic taping on changes in local blood flow in the upper extremity. The set-up of the experiment took into consideration the effect of physical effort and duration of skin-tape contact.

Material and Methods

Characteristics of the studied groups

The pilot study was performed on a group of 20 participants, 18 women and 2 men, students of the Poznań University of Physical Education, aged from 19 to 25 years. The study excluded persons who had had an injury of the upper extremity, take medication or engage in sports which require significant involvement of upper extremities (fencing, handball, volleyball). The participants were randomly allocated to one of two groups: the experimental (n = 15) or control group (n = 5). All measurements were taken at the premises of the Department of Biochemistry of the Poznań University of Physical Education.

Order of measurements

All participants were subjected to the same procedures, with the exception of the application of Kinesio Tape which was not performed in the control group.
After the volunteers filled in the personal questionnaire, their anthropometric measurements were taken (body mass and height, forearm circumference in the area of probe application). Then, after assuming a back lying position in order to stabilise blood flow, blood flow was recorded for 5 minutes using the PeriFlux System 5000 from Perimed. The next step was gripping the dynamometer three times in order to assess maximum handgrip strength using the dynamometer made by KERN MAP Version 1.0. This was followed by the application of the Kinesio Tape on the forearm finger flexors using the muscle technique in the experimental group. After the application, blood flow and hand grip strength were measured again. The participants reported in the Department of Biochemistry after 3 hours in order to carry out the same procedures.

Measurement of blood flow

Blood flow measurement was performed using a two-channel PeriFlux System 5000 (Perimed, Sweden), which records changes in local tissue blood flow based on the Laser-Doppler Perfusion Monitoring technique using probes attached to the forearm skin. The result of blood cell perfusion recording is the product of the concentration of moving blood cells elements within the recording area (i.e. all morphotic elements causing a Doppler shift effect) and mean velocity of morphotic blood elements [18].
The measurements were taken three times at rest (in the back lying position in order to rule out incorrect measurements) for 5 minutes, on a previously calibrated

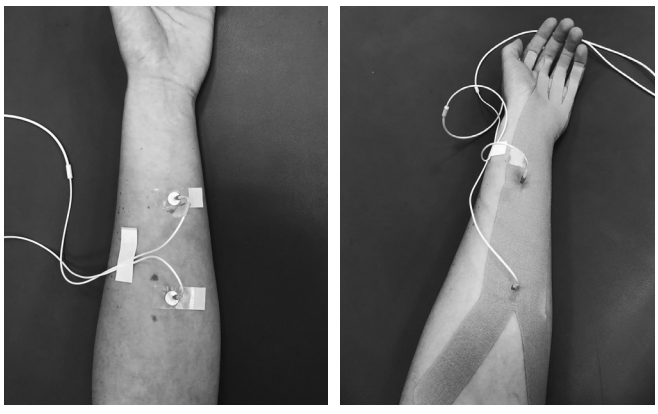

Figure 1. Probe application for the measurement of blood flow in the control group, without the tape (1) and in the experimental group (2)

device. The probes were attached to the forearm skin using special, self-adhesive probe holders supplied by the device manufacturer, at 1/3 and 2/3 of its length, from the radiocarpal joint, that is avoiding large blood vessels and preventing the occurrence of artefacts (Figure 1). The first recording of blood flow was performed after 10 minutes of rest, after the application of Kinesio Tape (in the experimental group) and after 3 hours.

Calibration and blood flow measurement

The PeriFlux System 5000 device was prepared for recording in accordance with the manufacturer's recommendations, using an original calibration set. In order to ensure correct operation and sensitivity of the device a test recording was carried out, which included measuring blood flow with and without the Kinesio Tape and after increasing the temperature of the application area with a Solux Lumina lamp placed at a distance of 20 cm. The above ensured maintaining the stable temperature of 37.8ºC in the area of measurement of one of the probes for a few minutes (PU1). Increasing tissue temperature was accompanied by a twofold increase in the blood flow registered by the probe, which decreased after the source of heat was switched off, reaching the initial value after approximately 2 minutes. The results of the test indicate the validity of using LD in studies assessing the effect of the KT method on changes in blood flow.

Kinesio Tape application procedure

Kinesio Tape was applied using a muscle technique, on the superficial finger flexor muscle (*Musculus flexor digitorum superficialis*) of the upper extremity in accordance with the generally accepted principles of taping. The procedure involved:

a) the application of the base on fingers II-V,
b) dorsiflexion of the radiocarpal joint,
c) application of the ends on the lateral and medial condyles of the humerus [25].

Statistical methods

Statistical analysis was performed using the IBM SPSS Statistics 24 package. Basic descriptive statistics were analysed and Shapiro–Wilk test for the assessment of normality of variable distribution was performed. This was followed by the intragroup one-way analysis of variance. The significance level of $\alpha = 0.05$ was adopted.

Results

The set of intragroup one-way analyses of variance, i.e. within the experimental and control groups, showed the lack of any differences between tests, i.e. between the first measurement – without the tape, the second measurement – immediately after the application, and the third measurement – three hours after the application. In case of mean hand grip strength it can be assumed that the results of individual measurements did not differ significantly, and Kinesio Taping did not significantly affect the change in hand grip strength (Table 1), both in the control and in the experimental group.

Table 1. Level of mean hand grip strength in individual tests in the control and experimental groups

Variable	Test	M	SD	ANOVA result
Mean hand grip strength (control group)	I	33.99	8.28	F(2; 8) = 2.46 p = 0.147
	II	35.24	7.71	
	III	33.49	7.79	
Mean hand grip strength (experimental group)	I	24.45	6.72	F(2; 28) = 0.73 p = 0.490
	II	24.59	6.59	
	III	24.96	6.31	

The results of measurement of blood flow (PU) in both groups, with no statistically significant differences noted, do not indicate the effectiveness of Kinesio Tape or the effect of duration of its action on skin (Table 2).

Table 2. Level of mean PU I and II in tests in the control and experimental groups

Variable	Badanie	M	SD	ANOVA result
Mean value of PU 1 (control group)	I	6.75	2.69	F(2; 8) = 1.29 p = 0.327
	II	6.85	3.57	
	III	8.41	4.31	
Mean value of PU 2 (control group)	I	3.15	1.59	F(2; 8) = 0.51 p = 0.618
	II	3.34	1.41	
	III	3.91	2.54	
Mean value of PU 1 (experimental group)	I	20.41	6.71	F(1.38; 19.37) = = 0.55 p = 0.521
	II	18.39	7.34	
	III	20.19	7.27	
Mean value of PU 2 (experimental group)	I	6.67	3.31	F(1.18; 16.49) = = 0.59 p = 0.482
	II	5.86	2.08	
	III	5.93	3.23	

It was also assessed whether there are any relations between hand grip strength and the values of PU 1 and 2. For this a series of correlation analyses with Pearson's r coefficient were performed, separately for

Table 3. Relation between hand grip strength and the mean value of PU 1 and 2 in subsequent measurements in the control group

		Mean hand grip strength I	Mean hand grip strength II	Mean hand grip strength III
Mean value of PU 1 (I)	Pearson's r	0.540		
	significance	0.348		
Mean value of PU 2 (I)	Pearson's r	–0.405		
	significance	0.499		
Mean value of PU 1 (II)	Pearson's r		0.436	
	significance		0.463	
Mean value of PU 2 (II)	Pearson's r		0.283	
	significance		0.644	
Mean value of PU 1 (III)	Pearson's r			0.296
	significance			0.628
Mean value of PU 2 (III)	Pearson's r			–0.313
	significance			0.608

Table 4. Relation between mean hand grip strength and mean PU 1 and 2 values in subsequent measurement in the experimental group

		Mean hand grip strength I	Mean hand grip strength II	Mean hand grip strength III
Mean value of PU 1 (I)	Pearson's r	–0.366		
	significance	0.180		
Mean value of PU 2 (I)	Pearson's r	0.108		
	significance	0.701		
Mean value of PU 1 (II)	Pearson's r		–0.002	
	significance		0.995	
Mean value of PU 2 (II)	Pearson's r		0.298	
	significance		0.280	
Mean value of PU 1 (III)	Pearson's r			**0.473**
	significance			**0.075**
Mean value of PU 2 (III)	Pearson's r			**0.527**
	significance			**0.043**

the first, second and third measurement in both groups. In the control group, no relations were noted even at the level of statistical trend (Table 3).

In the experimental group, the analysis of correlation between hand grip strength and PU value showed a statistically significant relation (Table 4). Hand grip strength positively correlated with PU 2 in the 3rd measurement. This means that with an increase in mean hand grip strength the mean value of PU 2 increased. A similar relation, but only at the level of statistical trend, was noted in the 3rd measurement for the area monitored by one of the probes (PU 1).

Discussion

Measurement of blood flow using the LD technique, as confirmed by the methodological study performed by the authors using a controlling thermal factor (see Material and methods), indicates that its application in

physiotherapeutic studies, also in the area of Kinesio Taping, is justified. KT, similar to each effective, recognised therapeutic method, affects specifically the processes taking place in body tissues, by inducing, strengthening or speeding up changes beneficial for them. The study undertaken by us refers to suggestions of other authors who have seen the positive effect of the method in an increased blood and lymph flow within the area where the tape was applied [10]. The above was supposed to induce an increased oxygen transport to muscles, followed by a potential improvement of its function [14, 19]. Starting from the assumption that Kinesio Taping leads to modulation of blood flow, the authors performed appropriate tests using the PeriFlux System 5000 device. The blood flow measurement method using Laser Doppler Flowmetry (LDF) applied in the study is a well-known, proven, and sensitive technique used by the authors in their earlier works [15, 17]. Only two publications are available in which the authors would verify the effectiveness of the KT method using LDF. Stedge et al. assessed blood flow in calf muscle using Laser Doppler Flowmetry after the application of dynamic taping [23]. The results of our measurements were consistent with the results of these authors, which would confirm also in other experimental system the lack of the direct influence of the tape on circulation in subcutaneous tissues. Taking into consideration the fact that the tapes were applied on the participants for at least 3 hours, we can even talk here about the lack of indirect effect caused by the activation of tissue and intracellular processes combined with triggering of secretion of second messengers. Therefore, it is interesting that Craighead et al. noted different results in their study, indicating a possible effect of Kinesio Taping on changes in blood flow, and moreover irrespective of the application technique [6]. The authors of the study referred to above assessed whether the degree of tape stretch and the effect of skin folding after application contribute to changes in blood flow, including red blood cells. They observed that KT may to a small extent affect the circulatory system, however it is still unexplained whether such a small difference may result in a therapeutic effect of tape application.

The creator of the KT method developed an application which after applying of the tape on a maximally stretched muscle is to increase muscle strength and effectiveness and improve the function as a result of increased blood flow and improved tissue nutrition [10]. In our study we also decided to assess the effect of KT on hand grip strength due to inconsistent results of other authors [12, 27]. Some of them, in studies of patients who did not report pain, noted increased hand grip strength (Kouhzad Mohammadi and Zhang [12, 27]). Others, like Cai and Kim [2, 11], obtained results contradicting this and consistent with our results.

Another aspect of the study was the effect of the duration of application on the effectiveness of the method. In the available bibliography significant number of the measurements assessing the effectiveness of KT are taken immediately after the tape application [3, 4]. Also this argument affected the choice of methodology adopted by the authors. Few authors have carried out observation of the effectiveness of the method over a longer time. An attempt to assess the effectiveness of tape application in this respect was made by Słupik et al., who studied healthy participants, assessing the effect of taping after 24 hours. In their opinion after this time the most noticeable was an increase in the bioelectric activity of the medial vastus muscle, which was maintained for 48 hours after the removal of the tape. Due to the process of voluntary muscle contractions, not the electric stimulation in the same conditions, it is difficult to assess the subjective effect on the participants in these tests [22]. Our results obtained both directly after the application of the tape and 3 hours after the application indicate that there were no changes in the hand grip strength and blood flow immediately after the application.

It is interesting that the only result which was statistically significant was the relation between hand grip strength measured after three hours of wearing the tape and an increase in blood flow after three hours. However, in order to draw clear conclusions these results need further studies on a larger number of participants. It cannot be ruled out that in a longer time than the three hours adopted by us, it is possible to induce processes contributing to the process of increase in muscle strength and tone or the intensity and enhancement of inflammation process reduction [22]. For this reason, it would be advisable to extend the studies of KT including biochemical indicators taking into consideration the activity of inflammation factors [5].

In the analysis of the study results it can be noted that the therapeutic effect of skin folding using elastic tape should not be seen as a method increasing local blood flow in healthy people. Moreover, the discrepancy in the results of the previous studies on effectiveness of KT confirms the need of further studies to assess any therapeutic effect of taping on a cellular level.

Conclusions

1. Kinesio Taping did not lead to changes in microcirculation in the area of tape application in healthy people.

2. Kinesio Taping did not change hand grip strength or the value of blood flow directly after the application and three hours after the application. However, the value of blood flow increased with the increase in hand grip strength in the group of people in whom KT was applied.

References

1. Brychcy A, Pawlak M. Pół wieku badań na temat kinesio tapingu – czym i jak mierzymy skuteczność terapii? (Half century of scientific research in field of Kinesio Taping – what and how do we check therapy effects?) Med Sport. 2018; 34(3): 135-153.
2. Cai C, Au IP, An W, Cheung RT. Facilitatory and inhibitory effects of Kinesio tape: Fact or fad? J Sci Med Sport. 2016; 19(2): 109-112.
3. Chang HY, Chou KY, Lin JJ, Lin CF, Wang CH. Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athlete. Phys Ther Sport. 2010; 11(4): 122-127.
4. Chang HY, Wang CH, Chou KY, Cheng SC. Could forearm Kinesio Taping improve strength, force sense, and pain in baseball pitchers with medial epicondylitis? Clin J Sport Med. 2012; 22(4): 327-333.
5. Choi JE, Nardo AD. Skin neurogenic inflammation. Springer Nature. 2018; 40: 249-259.
6. Craighead DH, Shank SW, Volz KM, Alexander LM. Kinesiology tape modestly increases skin blood flow regardless of tape application technique. J Perform Health Res. 2017; 1(1): 72-78.
7. Fukui T, Yuko O, Takashi K. The effects of new taping methods designed to increase muscle strength. J Phys Ther Sci. 2017; 29(1): 70-74.
8. Grześkowiak M, Szulc P, Szwedziak M, Lewandowski J. Wpływ metody Kinesio Tapingu na ruchomość odcinkową i fizjologiczne krzywizny kręgosłupa. Przegląd literatury (The effects of new taping methods designed to increase muscle strength). Ortop Traumatol Reh. 2014; 2(6): 221-226.
9. IIbeyguin R. Taping. Techniki – działanie – zastosowanie kliniczne (Techniques – performance – clinical use). Wrocław: Edra Urban & Partner; 2018.
10. Kase K, Hashimoto T, Okane T. Kinesio Taping Perfect Manual. Kinesio Taping Association, Japan; 1996.
11. Kim JY, Kim SY. Effects of kinesio tape compared with non-elastic tape on hand grip strength. J Phys Ther Sci. 2016; 28(5): 1565-1568.
12. Kouhzad Mohammadi H, Khademi Kalantari K, Naeimi SS, et al. Immediate and delayed effects of forearm kinesio taping on grip strength. Iran Red Crescent Med J. 2014; 16(8): e19797.
13. Kruszyniewicz J, Skonieczna-Żydecka K. Kinesiology taping jako propozycja postępowania fizjoterapeutycznego w sporcie (Kinesiology taping as a proposal of physiotherapeutic conduct in sport). Prakt Fizjoter Reh. 2018; 68.
14. Kubo K, Ikebukuro T, Tsunoda N, Kanehisa H. Changes in oxygen consumption of human muscle and tendon following repeat muscle contractions. Eur J Appl Physiol. 2008; 104(5): 859-866.
15. Kurosawa M, Messlinger K, Pawlak M, Schmidt RF. Increase of meningeal blood flow after electrical stimulation of rat dura mater encephali: mediation by calcitonin gene-related peptide. Br J Pharmacol. 1995; 114(7): 1397-1440.
16. Mosiejczuk H, Lubińska A, Ptak M, Szylińska A, Kemicer-Chmielewska E, Laszczyńska M, et al. Kinesiotaping jako interdyscyplinarna metoda terapeutyczna (Kinesiotaping as an interdisciplinary therapeutic method). Pomeranian J Life Sci. 2016; 62 (1): 60-66.
17. Pawlak M, Messlinger K, Zehnter A, Schmidt RF. Somatostatin reduces the meningeal arterial blood flow in the rat. Neurosci Lett. 1999; 276(1): 33-36.
18. Perimed, PeriFlux 5000. User manual. Järfälla; 2008.
19. Richardson RS. Oxygen transport: air to muscle cell. Med Sci Sports Exerc. 1998; 30(1): 53-59.
20. de Ru E. Elastic Therapeutic Taping in Pediatrics. Zutphen: GoPhysio; 2013.
21. Shah Y, Arkesteijn M, Thomas D, Whyman J, Passfield L. The acute effects of integrated myofascial techniques on lumbar paraspinal blood flow compared with kinesiotaping: a pilot study. J Bodyw Mov Ther. 2017; 21: 459-467.
22. Słupik A, Dwornik M, Białoszewski D, Zych E. Effect of Kinesio Taping on bioelectrical activity of vastus medialis muscle. Preliminary report. Ortop Traumat Reh. 2007; 9(6): 644-651.
23. Stedge HL, Kroskie RM, Docherty CL. Kinesio taping and the circulation and endurance ratio of the gastrocnemius muscle. J Athl Training. 2012; 47(6): 635-642.
24. Śliwiński Z, Krajczy M. Dynamiczne plastrowanie (Kinesio Taping). Wrocław: Markmed Rehabilitacja; 2014.
25. Yang JM, Lee JH. Is Kinesio taping to generate skin convolutions effective for increasing local blood circulation. Med Sci Monit. 2018; 24: 288-293.
26. Yasukawa A, Patel P, Sisung C. Pilot study: investigating the effects of Kinesio Taping® in an acute pediatric rehabilitation setting. Am J Occup Thera. 2006; 60(1), 104-110.
27. Zhang S, Fu W, Pan J, Wang L, Xia R, Liu Y. Acute effects of Kinesio taping on muscle strength and fatigue in the forearm of tennis players. J Sci Med Sport. 2016; 19(6): 459-464.